

REMARKS

Reconsideration of this patent application is respectfully requested in view of the foregoing amendments and the following remarks.

The amendments to this patent application are to amend Claims 1 and 11 to read as follows. The second step of both of claims 1 and 11 has been amended to read as follows:

"then treating the semiconductor wafers in a bath with an aqueous  $O_3$  solution only containing  $O_3$  and optionally HF".

The third step of both of claims 1 and 11 has been amended to read as follows:

"then treating the semiconductor wafers in a bath with an aqueous HCl solution only containing HCl and optionally  $O_3$ ".

The last paragraph in each of claims 1 and 11 has been amended to read as follows:

"whereby these treatment steps form a treatment sequence B<sub>2</sub>, which avoids rinsing with water or another treatment liquid and the addition of fresh water or other liquids to the

treatment baths." Support for this language added to the last paragraph of claims 1 and 11 is found in the present Specification on page 2, in the second paragraph and in the first sentence thereof.

The Patent Examiner has rejected claim 1 (and presumably also claim 11) under 35 U.S.C. § 112 as containing new matter. Specifically in line 7 of claim 1 the Patent Examiner has stated that "ozone only containing ozone" is new matter. Then in line 9 of claim 1 the Patent Examiner has stated that "HCl only containing HCl" is also new matter. The Patent Examiner, on page 5 of the Office Action, has stated that the applicant's Specification does not support using an ozone solution only containing ozone and an HCl solution only containing HCl. The Patent Examiner further states that on page 3 of the Specification the applicants have disclosed that the ozone solution may optionally contain HF and the HCl solution may optionally contain ozone. Therefore, the solutions may contain other substances, is the position of the Patent Examiner.

Hence in order to overcome this rejection under 35 U.S.C. 112, the above amendments were made to independent

claims 1 and 11 to indicate that in the ozone solution, HF may optionally be present and in the HCl solution that ozone may optionally be present.

For all these reasons, it is firmly believed that all the claims are now in complete compliance with the requirements of 35 U.S.C. 112. Withdrawal of this ground of rejection is respectfully requested.

Reconsideration and withdrawal are respectfully requested for the rejection of claims 1 to 11 as being anticipated under 35 U.S.C. 102 by, or as being obvious under 35 U.S.C. 103 over *Pirooz European Patent 0701275*.

*Pirooz* in column 3 in lines 8 to 13 discloses that after removal of the metals, the silicon wafers are rinsed for a period of at least about 0.1 minutes and typically about 2 to about 10 minutes in deionized water. The water preferably has a resistivity of about 3 to about 18 mega-Ohms, preferably greater than about 17 mega-Ohms.

Pirooz in column 3 in lines 35 to 41 discloses that if the ozonated bath is acid-free, the treated wafers may be immediately dried. If the ozonated bath contains hydrochloric acid or nitric acid, however, the treated wafers should be rinsed for a period of at least about 0.1 minutes and typically about 2 to about 10 minutes in deionized water having a resistivity of about 3 to about 18 mega-Ohms, preferably greater than about 17 mega-Ohms.

Pirooz in column 5 in lines 20 to 31 in the Example discloses the following seven steps:

1. 10 minutes in an SC-1 batch (1:10:50  $\text{NH}_4\text{OH}:\text{H}_2\text{O}_2:\text{H}_2\text{O}$ ) with megasonics at 70°C;
2. water rinse for 5 minutes;
3. 5 minutes in a metals removal solution (1:10:100  $\text{HF}:\text{HCl}:\text{H}_2\text{O}$ );
4. overflow water rinse for 5 minutes;
5. immersion in flowing ozonated water bath (14 ppm  $\text{O}_3$ ; metals each less than 0.01 ppb) for 5 minutes;
6. IPA (isopropylalcohol) dried for 10 minutes; and
7. Processed through a rapid thermal annealer (750°C for 4

seconds) in a nitrogen atmosphere.

Concerning the reference *Pirooz*, EP-701275, *Pirooz* clearly leads away from the present invention. According to the Example discussed above in this reference, rinsing with water is performed in steps 2 and 4. Step 4 is between the treating step 3 with HF and step 5 with ozone, respectively. Accordingly, *Pirooz* suggests including rinsing with water in step 4 between two treatments with liquids other than water. Moreover, *Pirooz* does not disclose treating wafers with HF and ozone and HCl which is the claimed sequence of steps. According to *Pirooz* it would not be possible to perform these three claimed treatments with HF, ozone and HCl without a rinsing step with water in between. This is because *Pirooz* teaches that there must be these two water rinse steps 2 and 4 as a required part of the *Pirooz* method procedure.

Therefore, the conclusion that the *Pirooz* reference would lead in an obvious way to the claimed method comprising separate and subsequent treatment steps with HF, ozone and HCl containing liquids, and devoid of a water rinse step is respectfully

traversed, as believed to be in error.

As mentioned above, the last paragraph of each claim now recites the following wording:

"whereby these treatment steps form a treatment sequence  $B_2$ , which avoids rinsing with water or another treatment liquid and the addition of fresh water or other liquids to the treatment baths."

As already emphasized, the present invention as claimed comprises sequentially subjecting semiconductor wafers to three different treatment baths. The three treatment steps must form a closed block  $B_2$ . This fact is acknowledged on page 3, lines 14-17 of this Final Office Action that Pirooz et al. teach rinsing the wafers with water between two different treatment steps at two different times. This Pirooz teaching of rinsing with water is clearly contradictory to the disclosure of the present patent application, and is contrary to the claimed invention.

It is respectfully submitted that the claim language "(...) firstly(...) then(...) then(...)" already clearly excludes any

further step which is not specified in these parentheses. Thus amended claims 1 and 11 exclude the two rinsing steps taught by the Pirooz reference. Moreover, the above-mentioned addition to the wording of the claims is believed to further define the claimed invention over the prior art teachings.

For all these reasons, it is firmly believed that this one prior art reference fails to provide an identical disclosure of the claimed invention. Hence the present invention is not anticipated under 35 U.S.C. 102. Withdrawal of this ground of rejection is respectfully requested.

In summary, claims 1 and 11 have been amended. In view of these amendments, it is firmly believed that the invention, and all the claims, are patentable under 35 U.S.C. 103 over the prior art reference applied by the Patent Examiner. A prompt notification of allowability is respectfully requested.

Respectfully submitted,  
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Enclosures: Marked-Up Version of Amended Claims.

I hereby certify that this correspondence is being sent to Patent Examiner  
Charlotte A. Brown at the U.S. Patent and Trademark Office by facsimile  
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MARKED UP VERSION OF AMENDED CLAIMS

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Claim 1 (Four Times Amended):

A process for the wet chemical treatment of semiconductor wafers with treatment liquids in baths, comprising the steps of

firstly treating the semiconductor wafers in a bath with an aqueous HF solution only containing HF and optionally HCl and optionally a surfactant;

then treating the semiconductor wafers in a bath with an aqueous  $O_3$  solution only containing  $O_3$ , and optionally HF; and

then treating the semiconductor wafers in a bath with an aqueous HCl solution only containing HCl and optionally  $O_3$ ;

whereby these treatment steps form a treatment sequence B<sub>2</sub>, which avoids rinsing with water or another treatment liquid and the addition of fresh water or other liquids to the treatment baths.

11. (Twice Amended) A process for the wet chemical

treatment of semiconductor wafers with treatment liquids in baths, comprising the steps of

firstly treating the semiconductor wafers in a bath with an aqueous HF solution only containing HF; and optionally HCl and optionally a surfactant;

then treating the semiconductor wafers in a bath with an aqueous  $O_3$  solution only containing  $O_3$  and optionally HF; and

then treating the semiconductor wafers in a bath with an aqueous HCl solution only containing HCl and optionally  $O_3$  with exposure to megasonic waves,

whereby these treatment steps form a treatment sequence B<sub>2</sub>, which avoids rinsing with water or another treatment liquid and the addition of fresh water or other liquids to the treatment baths.